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FEDERAL - STATE - PRIVATE

COOPERATIVE

SNOW SURVEY and WATER SUPPLY FORECASTS for ARIZONA

UNITED STATES DEPARTMENT of AGRICULTURE...SOIL CONSERVATION SERVICE,

SALT RIVER VALLEY WATER USERS ASSOCIATION

and

ARIZONA AGRICULTURAL EXPERIMENT STATION

Data included in this report were obtained by the agencies named above in cooperation with the Federal, State and private organizations listed on the last page of this report.

JAN. 15, 1961

UNITED STATES DEPARTMENT OF AGRICULTURE - SOIL CONSERVATION SERVICE

To Recipients of Cooperative Snow Survey and Water Supply Forecast Reports:

The climate of the cultivated and populated areas of the West is characterized by relatively dry summer months. Such precipitation as occurs falls mostly in the winter and early spring months when it is of little immediate benefit to growing crops. Fortunately, most of this precipitation falls as mountain snow which stays on the ground for months, melting later to sustain streamflow during the period of greatest demand during late spring and summer. Thus, nature provides in mountain snow an imposing water storage facility.

The amount of water stored in mountain snow varies from place to place as well as from year to year and accordingly, so does the runoff of the streams. The best seasonal management of variable western water supplies results from fore-knowledge of the runoff.

A snow survey consists of a series of about ten samples taken with specially designed snow sampling equipment along a permanently marked line, about 1000 feet in length, called a snow course. The use of snow sampling equipment provides snow depth and water equivalent values for each sampling point. The average of these values is reported as the snow survey measurement for a snow course.

Snow surveys are made monthly or semi-monthly beginning in January or February and continue through the snow season until April, May or June. Currently more than 1400 western snow courses are measured each year. These measurements furnish the key data for water supply forecasts.

By relating snow survey measurements taken over a period of years to spring-summer runoff during the same period, relationships have been developed which make it possible to forecast seasonal runoff several months in advance of occurrence. In order to make a forecast, once a forecast relationship has been developed, the maximum snow water content at previously selected key snow courses is usually entered in the forecast relationship. More accurate forecasts are often obtained when other factors such as soil moisture, base flow and spring precipitation are considered and included in the forecast relationships.

Listed below are the Federal-State-Private Cooperative Snow Survey and Water Supply Forecast reports available for the West which contain detailed information on snow survey measurements, streamflow forecasts, reservoir storage, soil moisture and other guide data to water management and conservation decisions.

PUBLISHED BY SOIL CONSERVATION SERVICE

REPORTS	ISSUED	LOCATION	COOPERATING WITH
RIVER BASINS			
COLORAGO AND STATE OF UTAH	MONTHLY (JANMAY)	SALT LAKE CITY, UTAH	UTAH STATE ENGINEER AND OTHER AGENCIES
COLUMBIA	MONTHLY (JANMAY)	BOISE, IOAHO	IOAHO STATE RECLAMATION ENGINEER
UPPER MISSOURI AND STATEOF MONTANA	MONTHLY (FEBMAY)	BOZEMAN, MONTANA	MONT. AGR. EXP. STATION
WEST-WIOE	OCT. 1. APR. 1. MAY 1_	PORTLANO, OREGON	ALL COOPERATORS
STATES			
ALASKA	MONTHLY (MARMAY)	PALMER, ALASKA	ALASKA S.C.D.
AR I ZON A	SEMI-MONTHLY(JAN.15 - APR.1)		SALT R. VALLEY WATER USERS ASSOC. ARIZ. AGR. EXP. STATION
COLORAGO ANO NEW MEXICO	MONTHLY (FEBMAY)	FORT COLLINS. COLORAGO	COLO. AGR. EXP. STATION COLO. STATE ENGINEER N. MEX. STATE ENGINEER
I OAHO	MONTHLY (FEBMAY)	BOISE, IOAHO	TOAHO STATE RECLAMATION ENGINEER
NEVAOA	MONTHLY (FEBAPR.)	. RENO, NEVAOA	NEVAGA DEPT. OF CONSERVATION AND NATURAL RESOURCES - DIVISION OF WATER RESOURCES
ORE GON	. MONTHLY (JANMAY)	PORTLANO, OREGON	ORE. AGR. EXP. STATION DREGON STATE ENGINEER
WASHINGTON-	MONTHLY (FEBMAY)	SPOKANE. WASHINGTON	WN. STATE DEPT. OF CONSERVATION
WYOMING.	MONTHLY (FEB. JUNE)	CASPER, WYOMING	WYOMING STATE ENGINEER
Copies of these various report	s may be secured from:	Head, Water Supply Forest Soil Conservation Service 209 S. W. Fifth Ave., Po	e.
	PUBLISHED BY	OTHER AGENCIES	
REPORTS	ISSUED		AGENCY
BRITISH COLUMBIA	MONTHLY (FEBJUNE)		RIGHTS BR., DEPT. OF LANOS AND T BLOG., VICTORIA, B.C., CANAOA
CALLEGRALA	MONTHLY (FER -MAY)	CALLE DERT OF WAY	TED DESCUBLES SACRAMENTO CALLE

MONTHLY (FEB.-MAY) _____ CALIF. DEPT. OF WATER RESOURCES, SACRAMENTO, CALIF.

FEDERAL - STATE - PRIVATE

COOPERATIVE

SNOW SURVEY and WATER SUPPLY FORECASTS for ARIZONA

(Salt, Verde, Gila and Part of Lower Colorado River Basin)

Report prepared by

Richard W. Enz, Snow Survey Supervisor
SOIL CONSERVATION SERVICE
POST OFFICE BOX 929
PHOENIX, ARIZONA

Issued by

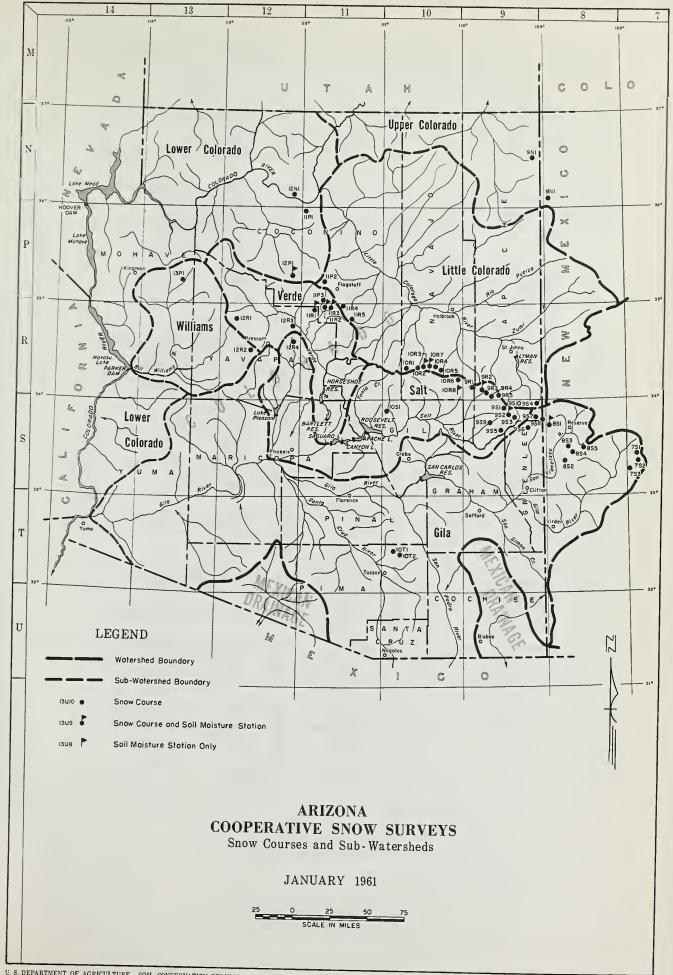
ROBERT V. BOYLE

STATE CONSERVATION IST
SOIL CONSERVATION SERVICE

VICTOR I. CORBELL

PRESIDENT
SALT RIVER VALLEY WATER USERS ASSOCIATION





INDEX to SNOW COURSES and SOIL MOISTURE STATIONS

NUMBER 36%	NAME	SEC	TWP	RGE ***	ELEVATION	RIVER BASIN
11P3 9S1 10T1 9S6	Antelope Park Baldy (p) Bear Wallow Beaver Head	29 28 6 13	19N 7N 12S LN	8E 27E 16E 30E	7300 9125 8100 8000	VerdeDiscontinued Salt-Little Colorado Gila Salt-Frisco
983	Big Lake Knoll	2	5N	28E	8800	Salt-Frisco-Little Colorado Discontinued
12N1	Black Canyon Black River Divide Bright Angel	8 2 11 34 3	13S 6N 33N 16N	11W**** 27E 3E 6W	6790 9100 8400 5700	GilaDiscontinued Salt-Little Colorado Lower Colorado Williams-Verde
12R1 10R3-M	Camp Wood Canyon Creek	18	11N	15E	7500	Salt-Little ColoradoReplaced by 10R7-M
10R7-M 11R2-M 12P1-M	Canyon Creek #2 Casner Park Chalender	18 19 27	18N	15E 8E 3E ng.11008 W.	7500 6930 7100	Salt-Little Colorado Verde Verde
10R8 - * 9S9	Corduroy Creek Corn Creek (p)	Lat.3300	07 'N. Lo: 15 'N. Lo:	ng.110008 W. ng.109045 W.	§ 6000 § 7730	Salt Not Read
8s3	Corner Mountain	7	10s	17W****	8850	Gila-Frisco Not Read
9s7	Coronado Trail	26	5N	30E	8000	Salt-Frisco
10R2	Elk	31	11N	14E	7600	Salt-Little ColoradoDiscontinued
10R6	Forest Dale	2	9N	21E	6430	Salt-Little Colorado
11P2	Fort Valley	22	22N	6E	7350	Verde-Little Colorado
9R5 8S1-M	Ft. Apache Frisco Divide	18 31 11	7n 6s 15n	27E 20W**** 2E	9160 8000 7600	Salt-Little Colorado Frisco-Gila
12R4 10R5 1 1 P1	Gaddes Canyon Gentry Grand Canyon	36 21	11N 30N	15E 4E	7600 7600 7500	Verde-Agua Fria Salt Lower Colorado
11R5	Happy Jack	30	17N	9E	7630	Verde
10R4	Heber (p)	28	11N	15E	7600	Salt-Little Colorado
7 S2	Inman	6	11S	10W****	7800	Gila
12R2	Iron Springs	22	14n	3W	6200	Williams-Verde
9S2	Maverick Fork (p)	13	6n	27E	9050	Salt
9R4	McKay Peak	13	7N	24E	8250	Salt Not Read Salt-Little Colorado Salt
9R2 - M	McNary	14	8n	23E	7200	
9R1	Milk Ranch	28	8n	23E	7000	
12R3	Mingus Mountain	3 2	15N	2E	7100	Verde-Agua Fria
8S2	Mogollon		11S	19W****	7000	Frisco-Gila
11R4	Mormon Lake	13	18N	8E	7350	Verde-Little Colorado
11R3-M	Mormon Mountain	14	18N	8E	7500	Verde
11R1-M	Munds Park	7	18N	7E	6500	Verde
8s4	N-Bar Lake	16	10S	17W****	8600	Gila Not Read Gila Not Read
8s5	Negrito	6	10S	16W****	8200	
984	Nutrioso	23	6N	30E	8500	Salt-Frisco-Little Colorado
985	Pacheta	At Town	of Mave	rick, Ariz.	§ 7800	Salt
9N1	Roof Butte	15	8N	6W*****	8500	Little Colorado Not Read
10T2	Rose Canyon	15	12S	16E	7300	Gila
9S8	State Line	6	6S	21W****	8000	Gila-Frisco
7S1	Taylor Creek	20	10S	10W****	7850	Gila
9R3	Trout Creek	5	7N	24E	6400	Salt Not Read
8N1	Washington Pass	Lat.36	21N. L	ong.108 ⁰ 50°W	§ 8600	Little ColoradoNot Read Williams Salt-Little Colorado
13P1	Willow Ranch	16	21N	11W	5000	
10R1	Woods Canyon	15	11N	13E	7640	
1081	Workman Creek	33	6N	14E	6900	Discontinued Salt

^{*} Soil Moisture Station only

**** NEW MEXICO PRINCIPAL MERIDIAN

አትኤኤት Navajo Base

 $[\]ensuremath{\mathcal{H}}\xspace$ Number indicates location of snow course within coordinate rectangle. Thus 9N1 is Course #1 in coordinate rectangle 9N.

 $^{{\}tt M}$ - Soil Moisture Station installed on or in vicinity of snow course.

⁹ UNSURVEYED

⁽p) STORAGE GAGE INSTALLED ON OR IN VICINITY OF SNOW COURSE.

ARIZONA WATER SUPPLY OUTLOOK

January 15, 1961

- SNOW COVER: Recent snow surveys indicate the snow cover to be below normal for this date. On the Salt and Gila River Watersheds, the snow pack is 62% and 133% of average, respectively. The Verde River drainage contains only 15% of normal snow. Seven out of eleven stations on this watershed reported no snow.
- PRECIPITATION: December precipitation has been very low and there has been nothing additional so far in January. The U. S. Weather Bureau reports the accumulated total since October is slightly above average. However, precipitation was far below normal three months prior to that time.
- SOIL MOISTURE: All stations showed the soil moisture to be very low with the exception of the first to second foot. Considerable precipitation will be required to fill the soil profile before good runoff can occur from the snow.
- RESERVOIR STORAGE: The eight major reservoirs serving Central Arizona are 36% of capacity and 156% of the average for January 15. The Salt River Project reservoirs are 59% of capacity and 175% of average, which is 5% less than one year ago. San Carlos Reservoir, however, contains only 2% of normal storage for this date. Unless very heavy runoff occurs on the Gila River this winter, extensive pumping will be required this irrigation season.

Generally, there is adequate stored water for this year's irrigation with some carryover available for next. San Carlos, Lake Pleasant and Show Low Lake, however, are far below capacity.

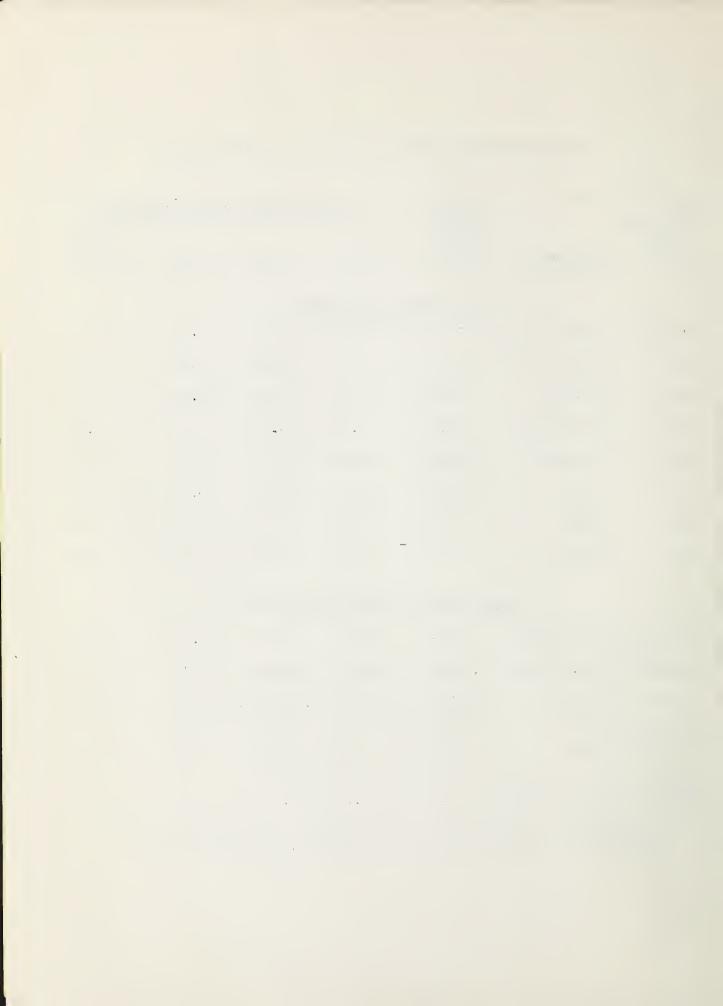
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STATUS OF ARIZONA RESERVOIR STORAGE - JANUARY 15, 1961

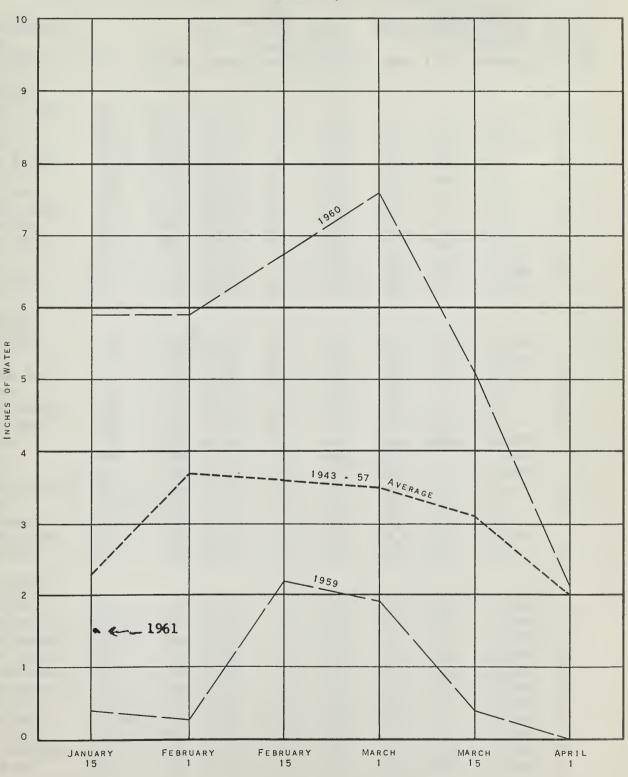
SUB-		USABLE	USAB	LE STORAGE	- 1000s A	CRE FEET
WATERSHED and/or STREAM	RESERVOIR	CAPACITY 1000s AC. FT.	1961	1960	1959	15-Year Average 1943-57
		GILA RIVE	R SUB-WATER	SHED		
Agua Fria	Lake Pleasant	163.8	27.1	44.2	18.1	20.5
Gila	San Carlos	1,205.0	1.6	127.9	110.4	80.3
Verde	Bartlett	180.0	19.7	125.9	103.8	27 . 3
Verde	Horseshoe	143.0	9.3	115.8	2.4	14.6%
Salt	Roosevelt	1,381.6	861.8	686.5	436.0	421.2
Salt	Apache	245.1	242.0	238.7	239.1	181.2
Salt	Canyon	57.9	48.6	57.0	56.8	31.9
Salt	Saguaro	69.8	48.1	68.8	62.5	24,4
	LOW	ER COLORADO	O RIVER SUB	-WATERSHED	!	
Colorado	Lake Havasu	619.4	533.7	548.1	545.8	552.0
Colorado	Lake Mohave	1,810.0	1,693.3	1,699.0	1,660.0	1,555.9*
Colorado	Lake Mead	27,207.0	19,150.0	19,415.0	21,759.0	17,849.0
Little Colorado	Lyman	30.6	6.6	10.0	18.0	5.6
Little Colorado	Show Low Lake	5.1	0.2	5.1	0.1	

^{*}Average is for less than 15 years of record in the 1943-57 period.



RELATIVE SNOW WATER ACCUMULATION in ARIZONA

JANUARY 15, 1961

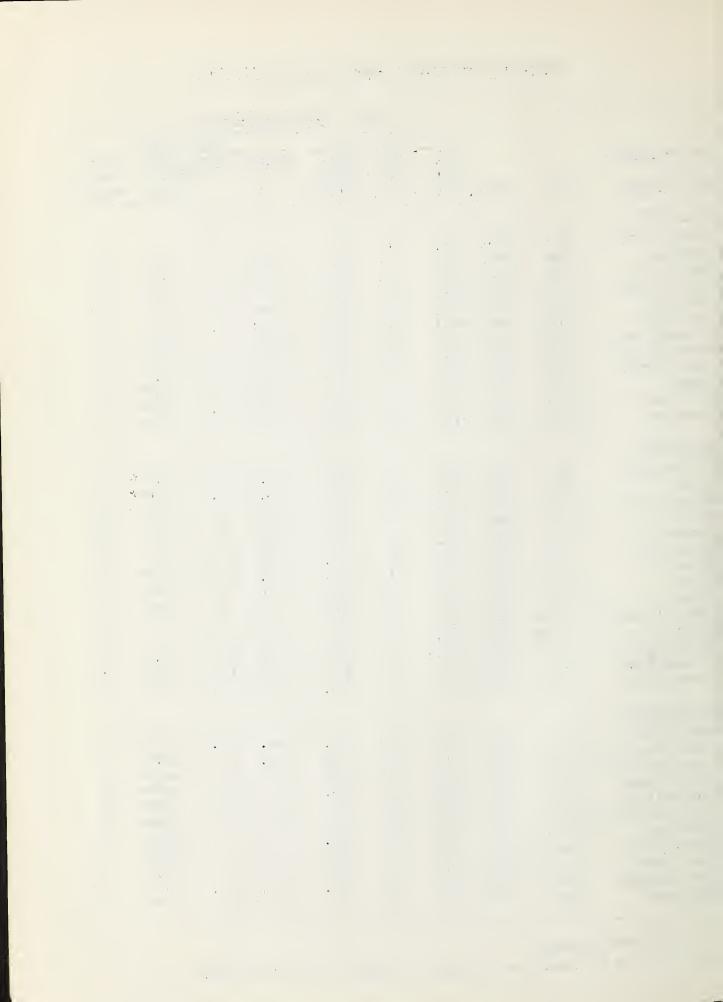


This graph represents the average snow water content on eleven selected snow courses on Arizona Sub-Watersheds.

				S	NOW COVER	MEASU	REMENT	S	
				1961			PAS	T RECORD	
SUB-WATERSHED			Date	Snow	Water	Water	Conte	nt (In.)	Prior
and			of	Depth	Content			1943-57	Yrs. of
SNOW COURSE	No.	Elev.	Survey	(In.)	(In.)	1960	1959	Average	Record
GILA RIVER									
Redstone Trail	887	8600	1/14	1.5	7.6			wag gan (A)	0
Nutrioso	984	8500	1/13	7	1.6	3.7	T	1.4	21
Bear Wallow	10T1	8100	1/13	3	0.7	9.1	0.0	2.2**	13
Frisco Divide	8S1-M	8000	1/13	9	1.9	4.9	0.6	1.3	20
Ice King	886	8000	1/14	12	4.4	~			0
State Line	988	8000	1/13	11	2.0	6.4	0.0	1.5	20
Coronado Trail	9S 7	8000	1/13	12	2.8	4.0	T	1.9	21
Beaver Head	986	8000	1/14	12	2.2	6.4	0.4	2.1	19
Taylor Creek	781	7850	1/13	0	0.0	3.0	0.0	0.5	17
Inman	782	7800	1/13	Ō	0.0	3.0	0.0	0.4**	14
Rose Canyon	10T2	7300	1/13	3	0.9	6.0	0.0	0.7**	13
Mogollon	8\$2	7000	1/14	10	2.2	3.2	T	0.5**	8
SALT RIVER									
Ft. Apache*	9R5	9160	1/15	14	3.1	8.7	1.6	4.4**	9
Baldy*	981	9125	1/15	14	3.2	8.3	0.9	3.6**	10
Maverick Fork	982	9050	1/15	15	3.6	9.8	T	4,92*	10
Nutrioso	984	8500	1/13	7	1.6	3.7	T	1.4	21
Coronado Trail	987	8000	1/13	12	2.8	4.0	T	1.9	21
Beaver Head	986	8000	1/14	12	2.2	6.4	0.4	2.1	19
Pacheta	985	7800	1/14	0	0.0	8.5	0.0	2.4**	11
Gentry	10R5	7600	1/14	3	0.8	6.7	T	1.4**	9
Heber	10R4	7600	1/14	3	0.9	7.2	T	1.4**	9
Canyon Creek #2	10R7-M	7500	1/14	3	0.8	6.5	T		3
McNary	9R2-M	7200	1/13	0	0.0	6,3	0.0	1.5	20
Milk Ranch	9R1	7000	1/13	0	0.0	4.4	0.0	0.8	19
Workman Creek	10S1	6900	1/13	0	0.0	8.8	1.2	2.8**	9
Forest Dale	10R6	6430	1/13	0	0.0	3.0	0.0	0.6	20
VERDE RIVER									
Happy Jack	11R5	7630	1/14	0	0.0	6.2	0.0	1.7**	8
Gaddes Canyon	12R4	7600	1/13	4	0.6	6.6	1.0	1.3**	7
Mormon Mountain	11R3-M	7500	1/13	3	0.6	5.2	1.0	3.0**	10
Mormon Lake*	11R4	7350	1/13	4	0.8	3.5	0.8	2.6**	14
Fort Valley*	11P2	7350	1/13	0	0.0	4.0	0.0	2.0**	14
Mingus Mountain	12R3	7100	1/13	0	0.0	2.9	0.0	0.8**	14
Chalender	12P1-M	7100	1/13	4	0.9	4.0	T	2.5**	14
Casner Park	11R2-M	6930	1/13	0	0.0	1.8	T	2.5**	10
Munds Park	11R1-M	6500	1/13	0	0.0	1.2	T	1.5**	9
Iron Springs*	12R2	6200	1/13	0	0.0	5.0	0.0	1.3**	15
Camp Wood	12R2	57 00	1/14	0	0.0	2.2	0.0	0.9**	14
F 3 a		3,00	1/ 14	U	0.0	4,2	0.0	0.0	. ·

^{*} On Adjacent Drainage.

^{**} Average is for less than 15 years of record in the base period.

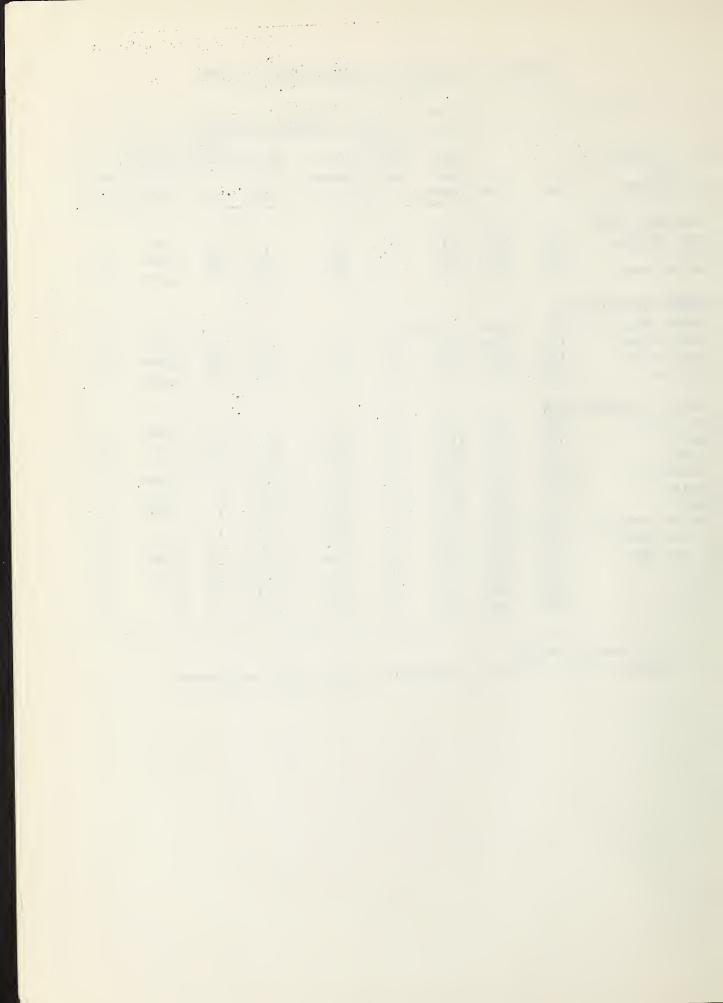


ARIZONA SNOW SURVEYS - ABOUT JANUARY 15, 1961

				SN	OW COVER	MEASUR	EMENTS		
				1961			PAS	T RECORD	
SUB-WATERSHED			Date	Snow	Water	Water	Conte	nt (In.)	Prior
and			of		Content			1943-57	Yrs. of
SNOW COURSE	No.	Elev.	Survey	(In.)	(In.)	1960	1959	Average	Record
WILLIAMS RIVER									
Iron Springs	12R2	6200	1/14	0	0.0	5.0	0.0	1.3**	15
Camp Wood*	12R1	5700	1/14	0	0.0	2.2	0.0	0.9**	14
Willow Ranch	13P1	5000	1/14	0	0.0	1.0	0.0	1.1**	13
LCWER COLORADO R	IVER								
Bright Angel	12N1	8400	No Surv	7ev		~ ~ ~		5.3**	11
Grand Canyon	11P1	7500	1/13	5	1.5	3.8	0.2	1.8**	13
Fort Valley	11P2	7350	1/13	0	0.0	4.0	0.0	2.0**	14
Chalender*	12P1-M	7100	1/13	4	0.9	4.0	T	2.5**	14
LITTLE COLORADO	RIVER								
Ft. Apache	9R5	9160	1/15	14	3.1	8.7	1.6	4.4**	9
Baldy	981	9125	1/15	14	3.2	8.3	0.9	3.6**	10
Nutrioso	984	8500	1/13	7	1.6	3.7	Т	1.4	21
Happy Jack*	11R5	7630	1/14	0	0.0	6.2	0.0	1.7**	8
Gentry	10R5	7600	1/14	3	0.8	6.7	T	1.4**	9
Heber	10R4	7600	1/14	3	0.9	7.2	T	1.4**	9
Canyon Creek #2	10R7-M	7500	1/14	3	0.8	6.5	T		3
Mormon Mountain	11R3-M	7500	1/13	3	0.6	5.2	1.0	3.0**	10
Mormon Lake	11R4	7350	1/13	4	0.8	3.5	0.8	2.6**	14
Fort Valley	11P2	7350	1/13	0	0.0	4.0	0.0	2.0 kk	14
McNary	9R2-M	7200	1/13	0	0.0	6.3	0.0	1.5	20
Forest Dale	10R6	6430	1/13	0	0.0	3.0	0.0	0.6	20

^{*} On Adjacent Drainage.

^{**} Average is for less than 15 years of record in the base period.



PRECIPITATION AT SELECTED ARIZONA STATIONS 1

		Precipitation	(Inches)	
	Dece	mber - 1960	Current Water Year (Oct. 1960 - Dec. 1960)		
STATION	Total	Departure from long term mean	Total	Departure from long term mean	
Ash Fork	No Repo	rt		day was not see	
Clifton	1.05	02	3.85	+ 1.57	
Douglas Smelter	. 21	50	1.14	64	
Plagstaff WBAS*	.39	- 1.47	5.23	+ 1.02	
Grand Canyon Hq.	1.37	14	5.69	+ 2.57	
Parker	No Repo	rt	62 may may may	a = = a	
Payson Ranger Station	°44	- 1.56	4.50	+ .01	
Phoenix WBAS*	.07	90	.74	- 1.10	
Prescott WBAS*	.09	- 1.28	2.59	08	
pringerville	1.14	÷ 。64	3.95	÷ 2.37	
Tueson WBAS*	•93	01	1.71	· <u>. 4</u> 6	
Vinslow WBAS*	1.12	÷ •59	2.84	⊦ 1 . 33	
Tuma WBAS*	.12	43	.12	89	

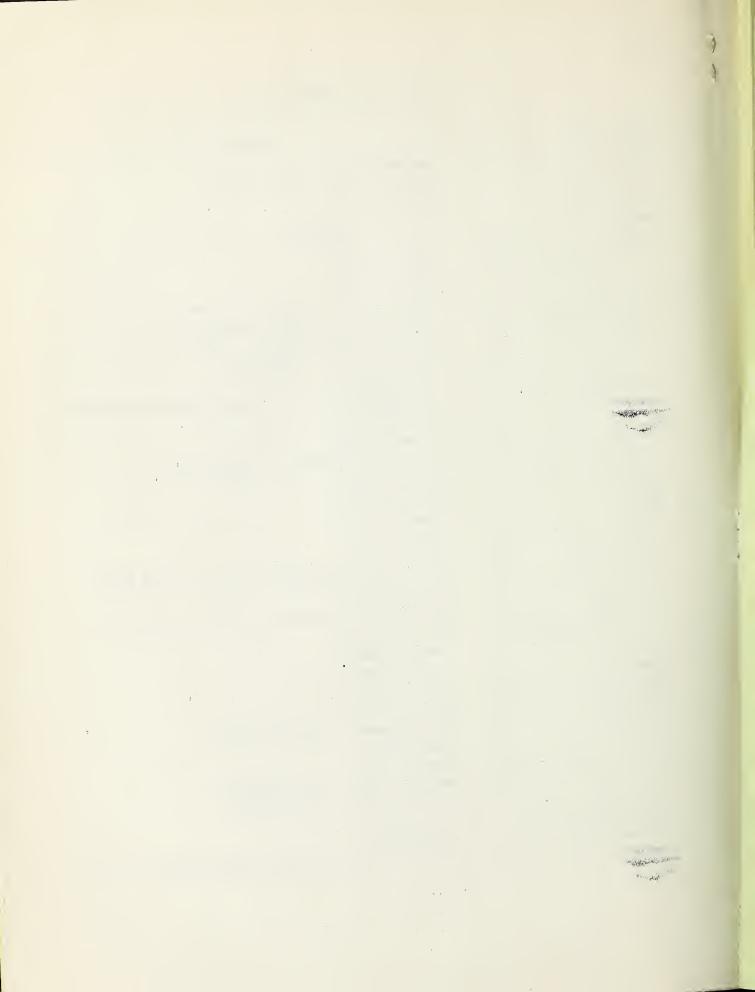
^{*}WBAS = Weather Bureau Airport Station

Data and Analysis furnished by Paul C. Kangieser, Arizona State Climatologist, U. S. Weather Bureau, Phoenix, Arizona.



LIST OF SNOW SURVEYORS

SNOW COURSE	SURVEYOR
Baldy	SCS and SRVWUA
Bear Wallow	Forest Service - Angus Porter
Beaver Head	N. A. Josh
Bright Angel	National Park Service
Camp Wood	Mrs. C. C. Merritt
Canyon Creek #2	SCS and SRVWUA
Casner Park	SCS and SRVWUA
Chalender	Forest Service - Oleson & Johanson
Coronado Trail	Forest Service - Bill Bráinard
Forest Dale	Fort Apache Reservation - Endfield and Boyer
Frisco Divide	Forest Service - Joe Clayton
Ft. Apache	SCS and SRVWUA
Fort Valley	Rocky Mountain Forest & Range Experiment Station
Caddes Canyon	SCS - Bill Gray
Gentry	SCS and SRVWUA
Grand Canyon	National Park Service - Robt. Heyder
Happy Jack	Emil O. Ryberg
Heber	SCS and SRVWUA
Ice King	James R. Wray
Inman	C. H. McCauley
Iron Springs	Ernest Saxby
McNary	Fort Apache Reservation - Endfield and Boyer
Maverick Fork	SCS and SRVWUA
Milk Ranch	Fort Apache Reservation - Endfield and Boyer
Mingus Mountain	SCS - Bill Gray
Mogollon	James R. Wray
Mormon Lake	SCS and SRVWUA
Mormon Mountain	SCS and SRVWUA
Munds Park	SCS and SRVWUA
Nutrioso	Forest Service - Bill Brainard
Pacheta	Foch Phillips
Redstone Trail	James R. Wray
Rose Canyon State Line	Forest Service - Angus Porter Forest Service - Joe Clayton
Taylor Creek	C. H. McCauley
Willow Ranch	Tiny Miller
Workman Creek	Rocky Mountain Forest & Range Experiment Station
MOTUMATI OTECK	worky modificatiff rotest & wante experiment station



The Following Organizations Cooperate in the Arizona Snow Survey Work

FEDERAL

Department of Agriculture

Soil Conservation Service

Forest Service

Apache Forest

Coconino Forest

Coronado Forest

Gila Forest

Kaibab Forest

Prescott Forest

Rocky Mountain Forest and Range Experiment Station

Department of Commerce Weather Bureau

Arizona Section

Department of Interior

Bureau of Reclamation Region III

Geological Survey
Arizona District

Bureau of Indian Affairs
Fort Apache Reservation

National Park Service
Grand Canyon National Park

Gila Water Commissioner Safford, Arizona

STATE

Arizona Agricultural Experiment Station

IRRIGATION PROJECTS

Salt River Valley Water Users' Association Phoenix, Arizona

San Carlos Irrigation and Drainage District Coolidge, Arizona

PRIVATE

Southwest Lumber Mills, Inc. McNary, Arizona

Other organizations and individuals furnish valuable information for the snow survey reports. Their cooperation is gratefully acknowledged.

OFFICIAL BUSINESS

FIRST CLASS WAIL

Federal - State - Private
COOPERATIVE SNOW SURVEYS

Furnishes the basic data necessary for forecasting water supply for irrigation, domestic and municipal water supply, hydro-electric power generation, navigation, mining and industry

"The Conservation of Water begins with the Snow Survey"